LOWER MADISON RIVER FISHERY INVESTIGATION

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INTRODUCTION

Two sections of the lower Madison River were electrofished during 1989 and 1990 for the purpose of collecting fish population data. The data are to be used in conjunction with other studies of thermal conditions and fish populations to provide basic information for consideration of Montana Power Company's hydro relicensing proposal. Additional fishery data for the Madison River has been published in numerous progress reports over the past 25 years.

STUDY AREA & METHODS

The two electrofishing sections studied are the Norris section, a 4.0 mile reach extending from the confluence of Hot Springs Creek to the mouth of Cherry Creek; and the Greycliff section, a 3.2 mile reach lying between the Greycliff and Cobblestone fishing access sites about 17-20 miles upstream from the confluence of the three forks of the Missouri and 6 miles downstream from the lower end of the Norris section (Figure 1).

Both electrofishing sections are low gradient (15-20 feet/mile). The channel is wide (200-300 feet) and flat with depths seldom exceeding 3 feet. Substrate is primarily cobble, gravel, and silt. During the summer months much of the substrate is matted with aquatic vegetation.

The riparian zone in the Norris section is narrow, comprised primarily of shrubs (rose, willow) and grasses. As the name suggests, the Greycliff section is largely bounded by tall clay cliffs on the west side with a more extensive cottonwood-dominated riparian zone to the east. The Greycliff section contains numerous side-channels and islands whereas the Norris section is primarily restricted to a single channel. Both Cherry Creek at the lower end of the Norris section and Elk Creek (between the two sections) contribute significant silt loads to the Greycliff section.

Electrofishing estimates were conducted on both sections during the spring of 1989 and 1990 and on the Greycliff section during the fall of 1989. Standard Petersen mark-recapture methodology was used with two to four marking runs followed by a 10-day rest and then 2-4 recapture runs. A fixed-boom electrofishing boat with an outboard jet was used on the Greycliff section and during two runs on the Norris section in Spring 1990. Most of the Norris work was done with a mobile-electrode system using a float-boat. There did not seem to be any noticeable difference in capture efficiency between the systems. However, the jet boat allowed for multiple runs through the same section.

Data output was prepared using the DFWP computer program (Vincent et al., 1981). Ages of fish were determined from acetate scale impressions of a representative sample of ten or fewer fish per half-inch group collected during each estimate.

RESULTS

Trout population levels and biomass in the Norris section were several times higher than in the downstream Greycliff section (Table 1). Total estimated trout population (age two and older) in the Norris section was 5,576 per mile in Spring 1989 and 3,887 per mile in Spring 1990. In the Greycliff section total estimated trout population levels (age two and older) were 953 per mile in Spring 1989. The 1990 estimates were invalid for younger age classes. Spring biomass of age two and older trout was estimated at 3,342 pounds per mile in the Norris section during 1989 compared to only 787 pounds per mile at Greycliff.

The Norris section also held 3-3-1/2 times higher numbers of fish 13 inches and larger during 1989 and 1990 (Figure 2). Condition factors of fish in the Norris section were generally 1-2 points lower than at Greycliff but both sections had average condition factors in the mid to high 30s, well within acceptable limits for early spring samples.

Growth rates of trout appear to be greater in the Greycliff section. This is particularly apparent for rainbow trout which generally were two or more inches longer than fish the same age from the Norris section (Table 2).

DISCUSSION

The trout population of the Greycliff section of the Madison River clearly does not achieve its potential. Recruitment may be limiting as estimated numbers of age two fish in the spring (which should not be impacted by angling) are low. Coupled with low recruitment are high annual mortality rates for the period 1989-1990 on age three and older trout. Age 3+ rainbow suffered 76% annual mortality with the bulk of that loss occurring during summer (May-September) when the population of 3+ rainbow declined 62%. Brown trout age three and older suffered a similar 76% decline between May 1989 and March 1990 with a 56% decline during the summer months.

While one year does not provide definitive evidence, it does appear that excessive summer mortality is occurring in the Greycliff section. The source of that mortality is unknown but speculation would attribute it to either angler harvest, thermal stress, or both.

Fall estimates were not conducted in the Norris section during 1989 and thus did not allow comparison of summer mortality rates. Total annual mortality in the Norris section (1989-1990) was 69% for age 3+ rainbow and 65% for age 3+ brown trout; one of the highest annual rates on record since annual estimates were begun in 1967 and quite similar to rates found in the Greycliff section.

Population levels in the Norris section appear to have improved during the past twenty years (Table 3). A comparison of 1972-75 data (Vincent 1976) to recent data from 1986-90 show average numbers have increased, especially for age three and older rainbow which averaged 417 per mile in 1972-75 and 1,086 per mile in 1986-90. Fishing pressure has always been heavy in this reach of river due to easy access (paralleled by the highway). The limit was 10 fish during 1972-75 and five fish during the 1986-90 period. Brown trout numbers have also increased but the increase was skewed more towards smaller fish.

Vincent (1983) provided convincing evidence that high summer water temperatures have caused reduced growth and condition of trout in the Norris section of the Madison River. Thermal stress is probably the major factor responsible for the exceedingly poor growth rates of rainbow trout in that reach of the river. Rainbow trout in the Norris section do not achieve 13 inches in length until they are five years old (Table 2) and consequently the numbers of larger rainbows in this reach of the river are low. Brown trout growth rates are considerably better. Poor growth rates of rainbow trout are a major limiting factor on the quality of this fishery. McMichael (1989) also demonstrated that high summer water temperatures in the Norris section result in reduced angler catch rates.

The negative impacts of thermal stress on the trout in the Norris section have been well-documented. As recently as June and July, 1988 fish kills were observed on the Norris and Greycliff sections as maximum water temperatures exceeded 82° F. While the 1988 fish kills may account for the presently low populations in the Greycliff section it seems unlikely that thermal problems would account for the entire population differential (an approximate 4-fold difference) between the Norris and Greycliff sections.

The low trout population in the lower Madison River may also be partially a result of poor recruitment, possibly as a consequence of sedimentation, in combination with excessive angler mortality. Estimates in 1989 and 1990 place the population level of fish over 13 inches at only 300-400 per mile. A substantial harvest combined with possible high hooking mortality of released fish as a result of warm water temperatures could easily keep the population from recovering. Further investigation may lead to a recommendation for more restrictive fishing regulations to try to improve the situation.

TABLE 1. Estimated trout populations (number/mile) in the Norris and Greycliff sections of the Madison River during spring 1989 and 1990. Total biomass (pounds/mile) in parentheses.

NORRIS SECTION

Age	Rainbow Trout		Brown Trout	
	3/15/89	3/16/90	3/15/89	3/16/90
2	142	201	2,713	1,164
3	374	374	641	1,257
4	558	276	479	274
5+	441	149	228	192
Total Numbers	1,515	1,000	4,061	2,887
(Biomass)	(876)	(467)	(2,466)	(1,897)

GREYCLIFF SECTION

Age	Rainbow Trout		Brown Trout	
	5/5/89	3/20/90	5/5/89	3/20/90
2	89	No Est.	223	No Est.
3	162	No Est.	219	220
4	82	30	95	73
5+	6	29	77	22
Total Numbers	339	No Est.	614	No Est.
(Biomass)	(222)	(No Est.)	(565)	(No Est.)

TABLE 2. Comparison of average length (inches) by age class for brown and rainbow trout from spring 1989 and 1990 electrofishing samples in the Norris and Greycliff sections of the Madison River.

	Rainbow Trout		Brown Trout	
Age	Norris	Greycliff	Norris	Greycliff
2	8.3	10.0	9.5	9.8
3	9.8	12.2	13.0	13.5
4	11.8	13.8	15.4	16.2
5	13.5	15.9	17.3	17.9

TABLE 3. Comparison of estimated average trout population levels (number per mile) in the Norris section of the Madison River during spring 1972-75 (Vincent, 1976) vs. 1986-90.

	Rainbow Trout		Brown Trout	
Age	1972-75	1986-90	1972-75	1986-90
2	586	356	569	1,245
3	309	556	560	643
4+	108	530	490	598
Total	1,003	1,442	1,619	2,486

LITERATURE CITED

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